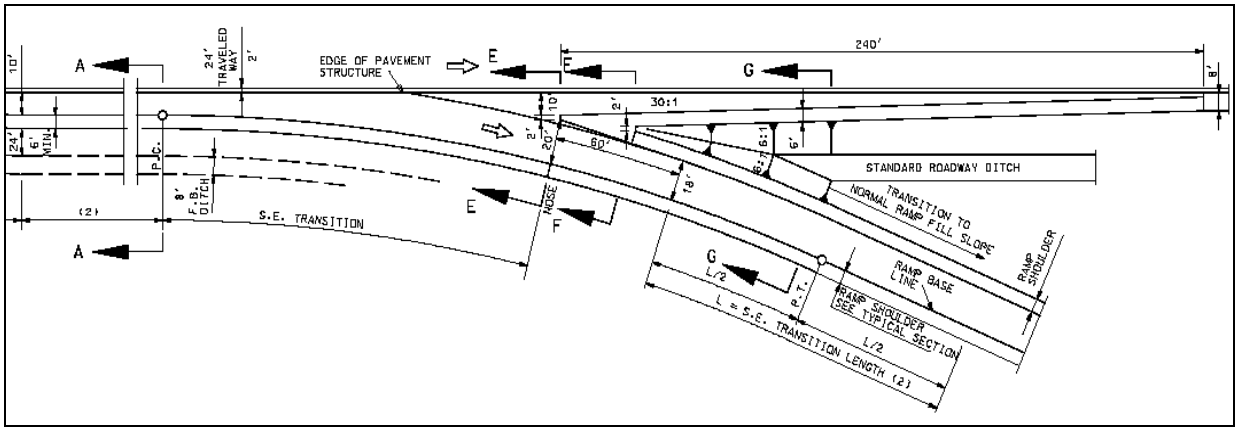
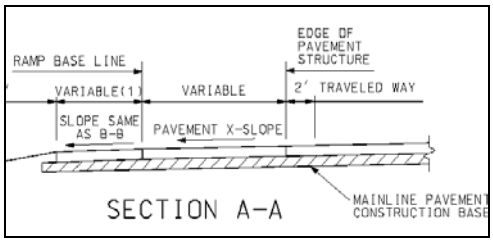
Ramp Transition Exercise

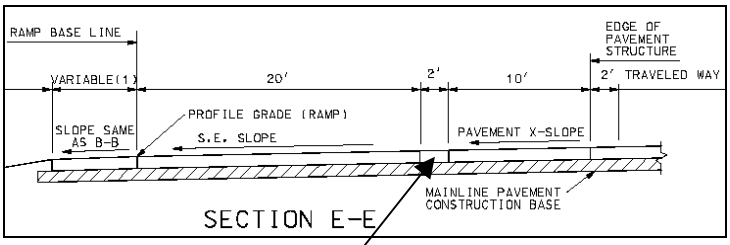
Objective and Background Information

The objective of this exercise is to demonstrate how the GEOPAK shape tools and COGO can be used to create a profile for a ramp transition. This is the area between the sections A-A and E-E in the following figure from Missouri Standard Plans for Highway Construction (203.41). The profile will be applied along the ramp chain.



As the figure indicates, the ramp is in superelevation transition from the pavement cross slope at Section A-A to the superelevation required for the beginning curve of the ramp at Section E-E. These two sections as shown in the standard plans are provided below.





The break in the slope between the mainline and the ramp can occur anywhere within these 2'

Before proceeding with the steps to create the profile, a decision needs to be made regarding the location of the break line between the mainline and ramp cross slopes. According to the Design Standards group, the exact location of this break line at Section E-E is not set. It can be located anywhere within the two-foot width of the ramp nose. For the purposes of this exercise, it will be located on the ramp side of the nose and held at a constant offset of 20' relative to the ramp chain from the ramp nose back to the point where this offset intersects with the mainline edge of pavement. As a designer, you can determine its location for your project.

Also needed is the superelevation rate at the ramp nose, which is base on the design speed of the ramp and the radius of the curve. The radius of the first curve in Ramp 2 is 1,041+ feet.

The relevant portion of the superelevation table from Missouri Standard Plan 203.20F is shown below. Based on e_{max} = 8%, the ramp's design speed of 40 M.P.H. and a rounded radius of 1000', the superelevation for the start of the ramp is 6.0%.

SUPERELEVATION AND WIDENING TABLE, e_{max} = 8%

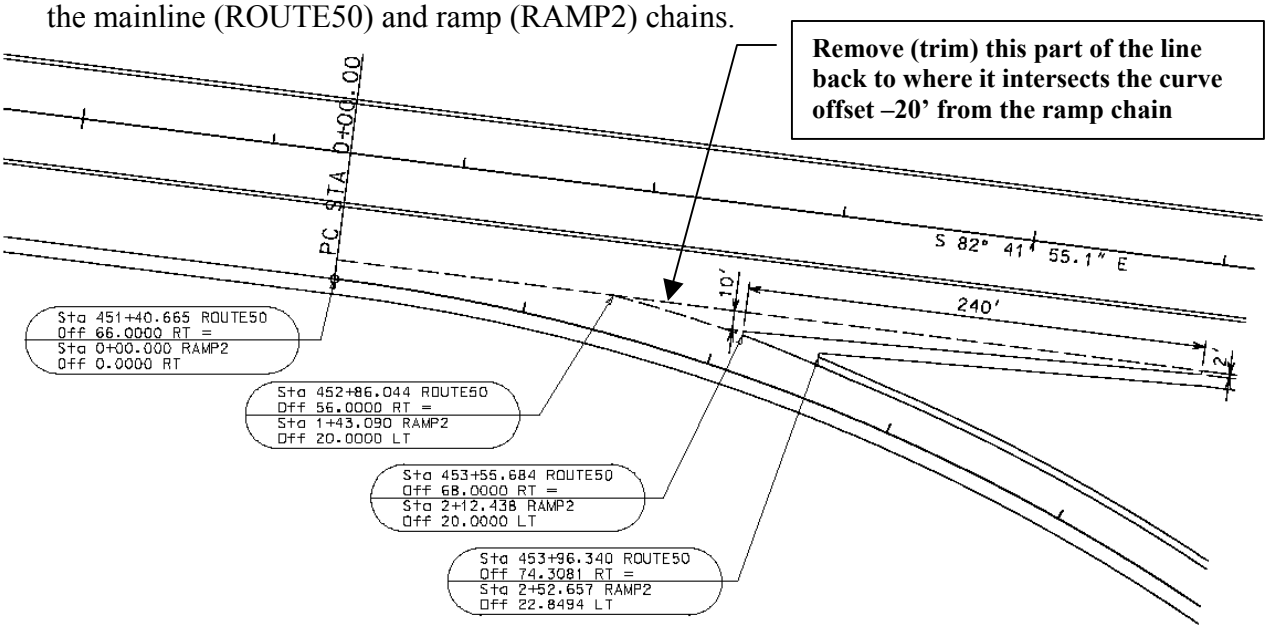
DESIGN SPEED	30 M.P.H. OR LESS					40 M.P.H.					50 M.P.H.				
NORMAL SURFACE WIDTH			20'	22'	24'			20'	22'	24'			20'	22'	24'
RADIUS (FEET)	e%	L	W			e%	L	W			e%	L	W		
17000	NC	0	0	0	0	NC	0	0	0	0	NC	0	0	0	0
14000	NC	0	0	0	0	NC	0	0	0	0	NC	0	0	0	0
12000	NC	0	0	0	0	NC	0	0	0	0	NC	0	0	0	0
10000	NC	0	0	0	0	NC	0	0	0	0	NC	0	0	0	0
8000	NC	0	0	0	0	NC	0	0	0	0	NC	0	0	0	0
6000	NC	0	0	0	0	NC	0	0	0	0	RC	48	0	0	0
5000	NC	0	0	0	0	RC	41	0	0	0	2.4	58	2.0	0	0
4000	NC	0	0	0	0	RC	41	2.0	0	0	2.9	70	2.0	0	0
3500	NC	0	0	0	0	2.3	48	2.0	0	0	3.2	77	2.0	0	0
3000	RC	36	2.0	0	0	2.6	54	2.0	0	0	3.7	89	2.5	0	0
2500	RC	36	2.0	0	0	3.0	62	2.5	0	0	4.3	103	2.5	0	0
2000	2.4	44	2.5	0	0	3.7	77	2.5	0	0	5.1	122	2.5	0	0
1800	2.6	47	2.5	0	0	4.0	83	3.0	0	0	5.5	132	3.0	2.0	0
1600	2.9	53	2.5	0	0	4.4	91	3.0	0	0	5.9	142	3.0	2.0	0
1400	3.2	58	3.0	0	0	4.8	99	3.0	2.0	0	6.4	154	3.0	2.5	0
1200	3.6	65	3.0	2.0	0	[illegible]	112	3.5	2.5	0	7.0	168	3.5	2.5	0
1000	4.2	76	3.5	2.5	0	6.0	124	3.5	2.5	0	7.6	182	3.5	3.0	2.0
900	4.5	82	3.5	2.5	0	6.4	132	4.0	3.0	2.0	7.8	187	4.0	3.5	2.5

Procedure:

The following steps will be used to create the ramp profile:

A. In the plan view drawing, place a color 0 break line on level 20 to indicate the location of the switch between the mainline and ramp slopes. This line is needed for the proposed cross sections. This break line should consist of simple elements and not be a line string.
B. In the shapes file, with the mainline shapes already plotted, place a line along the edge of the shape(s) next to the ramp. This line is to begin 5' before the beginning mainline station for the ramp transition and go to the ending mainline station of the transition.
C. Create a complex MicroStation element (using the same mainline station range as used in step B) at the location of the break line created in the plan view drawing. Note that this line string will be longer at its beginning than the break line drawn in step A.
D. Determine the cross slope on the ramp at each end of the transition. The cross slope at one end will match the mainline cross slope and will be at full superelevation for the ramp horizontal curve at the other end.
E. Use the Shape Analyst to find the elevation at the end of the break line as projected from the mainline shape next to the ramp. Based on this elevation and the cross slope for the ramp at this point, calculate the projected elevation along the ramp chain.
F. Store points along the ramp chain using the Shape Profiler in the continuous extrapolation mode to project the main line cross slope to the break line and the ramp cross slope from the break line to the ramp chain.
G. Re-station the points by create a dummy chain form the list with the beginning station set to match the ramp station at that point.
H. Create a point profile from the list of points, which will be the profile for the ramp transition.
I. Move the last VPI in this profile to the station and elevation obtained in step E.
J. Extend the ramp profile by added needed VPI points and vertical curves.

1. Open the MicroStation file **t:\de-proj\cole\j5p0100\data\plan_50_J5P0100.dgn** and adjust the window area to the beginning of Ramp 2, as shown below. The white dashed lines indicate the location of the mainline edge of pavement at the ramp and the -20' offset from the ramp chain. Several key points are labeled giving the station and the offset of the point relative to the mainline (ROUTE50) and ramp (RAMP2) chains.



Trim the east (right) **end of the dashed line** showing the mainline edge of pavement **back to where it intersects the curve offset –20' from the ramp**. **Save the changes to the DGN**.

Enter the GEOPAK project **t:\de-proj\cole\j5p0100\poject\j5p0100.prj** as **ClsUser** and select the **50EBL** working alignment.

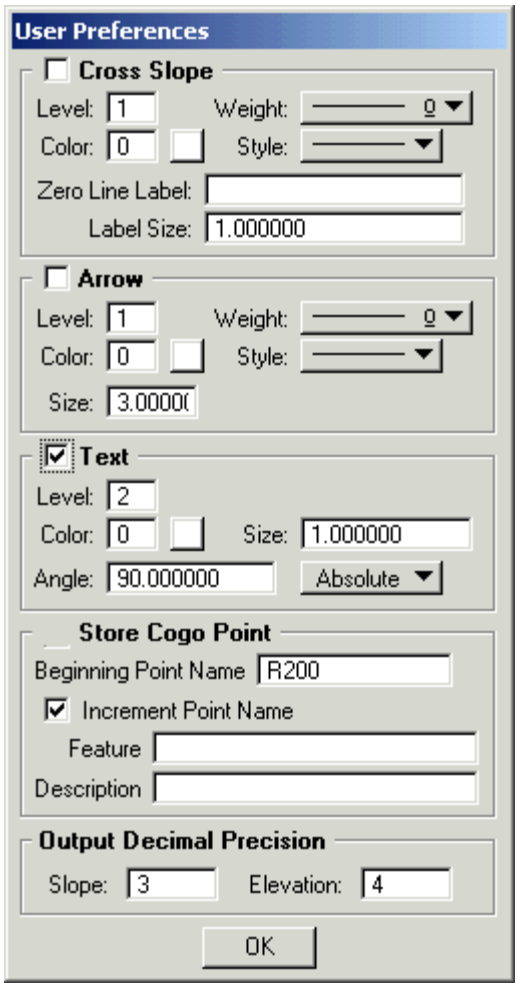
2. Open the MicroStation file **t:\de-proj\cole\j5p0100\data\ramps_shape.dgn** and adjust the window area to the beginning of Ramp 2.

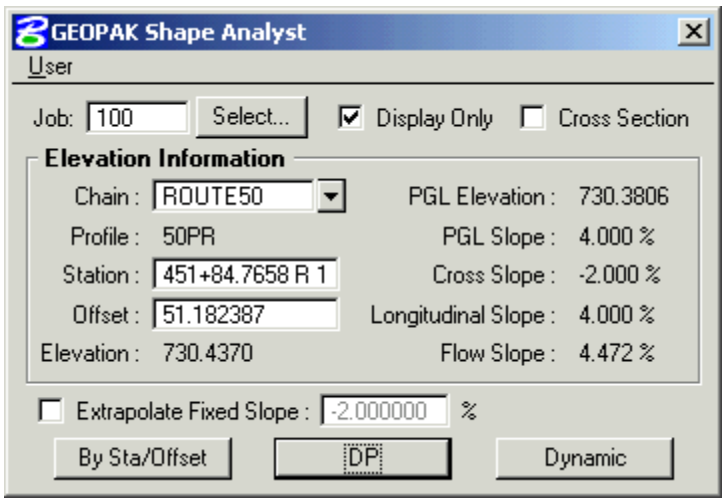
   The shape analyst tool will be used to determine the elevation projected from the mainline shapes where the break line intersects the ramp nose. This elevation will be used to determine the elevation for last VPI in a point profile for the ramp transition. The Shape Profiler will be used later to generate the rest of the VPI elevations.

   To activate the **Superelevation Shape Manager Tools** select the forth icon from the right in the Cross Sections toolbox shown below:

   The Superelevation Shape Manager Tools are shown to the right. Select the **Shape Analyst** from the dialog. It is the forth icon from the left as shown in the figure.

2. (Continued) The **Shape Analyst** tool is shown below on the right.





In the Shape Analyst, shown above, toggle on **Display Only**, select the **DP** button, and data point inside the color-5 shape for Route 50 at the start of the ramp. This lets us know that the cross slope for Route 50 at this point is –2%. It provides other information about the shape as shown in the dialog. You will have different information based on the location of your DP.

Open **User > Preferences** and toggle on **Text**, with the settings shown to the left. Close the dialog by clicking on **OK**.

Turn off Display Only.

Select the **DP** button, **snap** to the **outside edge of the ramp nose** (Route 50 Sta. 453+55.984, offset 68’ to the right), and data point to accept. The **elevation at this location is 736.9673** as projected from the Route 50 shapes.

3. The Shape Profiler will be used to extrapolate the elevations from the mainline shapes onto the ramp chain to locate the VPIs for the profile. Elevations will be determined at 5’ increments. Before doing this, lines need to be added to the shapes file to let the profiler know how to extrapolate the elevations.

   The first line needs to be along the outside edge of the mainline shapes start 5’ before the ramp transition and going to the other end of the transition. For this project the line needs to run from Route 50 station 451+35.665 (5’ before the start of the ramp) to station 453+55.984, which is the mainline station at the ramp nose, with a constant offset of 54’

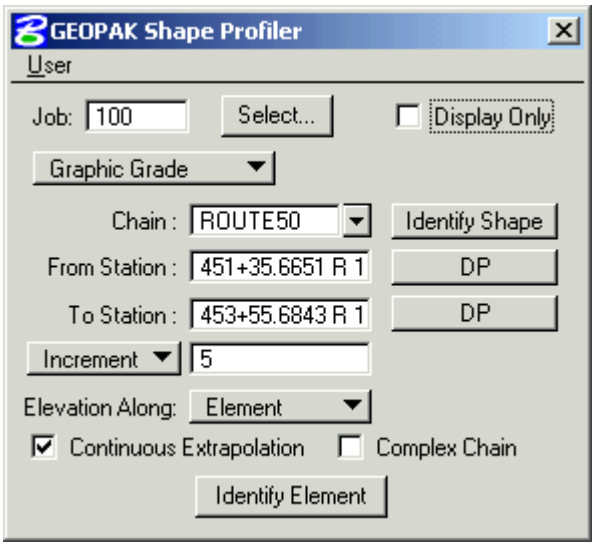
   Use Draw Transition to place a line on level 2 at a constant offset of 54’ from Route50 Station 451+35.665 to 453+55.984.

3. (Continued) The second line needs to be a single element that defines the change in cross slope. For this project the line will be offset 56' from Route50 Station 451+35.665 to Station 452+86.044, which is the same a Ramp2 Station 1+43.090 with an offset of -20'. The line continues from that point with a constant offset from Ramp2 Station 1+43.090 to Station 2+12.438.

   Use Draw Transition to place a line on level 2 at a constant offset of 56' from Route50 Station 451+35.665 to 452+86.044. Draw a second line with a constant offset of -20' from Ramp2 Station 1+43.090 to Station 2+12.438.

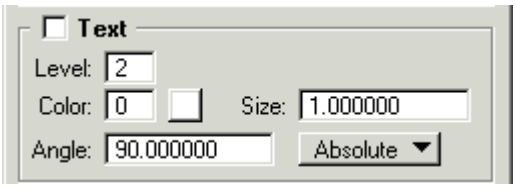
   Use the MicroStation Create Complex Chain tool to create a single element from these two lines. The tool is the one selected in the MicroStation Groups toolbox shown below.

4. With the needed lines in place **open the Shape Profiler.** It is the forth icon from the right in the Superelevation Toolbox. The Shape Profiler dialog is shown below on the left.



The Shape Profiler uses the same User Preferences dialog as the Shape Analyst. **Go to User > Preferences and turn off the text option** as shown below since the elevations at the edge of the shape are not needed.

Click **OK** to save the changes to the preferences.



Click on **Identify Shape** in the Shape Profiler and **select the edge of the color-5 shape for Route 50 adjacent to the Ramp 2**. This will fill-in the Chain field in the dialog as well as the shape's from and to station values.

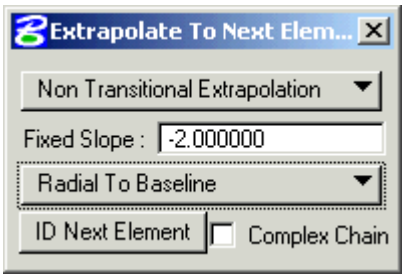
Click on the **DP** button next to the **From Station** field and **snap on the end of the complex element** created in the previous step **near the beginning of the ramp**. Accept the snap.

4. (Continued) Click on the **DP** button next to the **To Station** field and **snap on the end of the same element** at **the ramp nose**. Accept the snap. This will set the station range for the Shape Profiler.

   Set the distance between points option to an **Increment** of **5**, as show in the above dialog figure. This area of the dialog is directly below the station range fields.

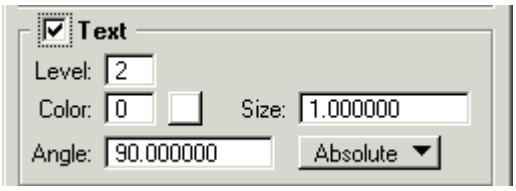
   Set **Elevation Along:** to **Element**. Have **Continuous Extrapolation toggled on** and **Complex Chain turned off**.

   Click on the **Identify Element** button and select line created in the previous step that runs along the edge of the Route 50 shape. This will bring up the following dialog:



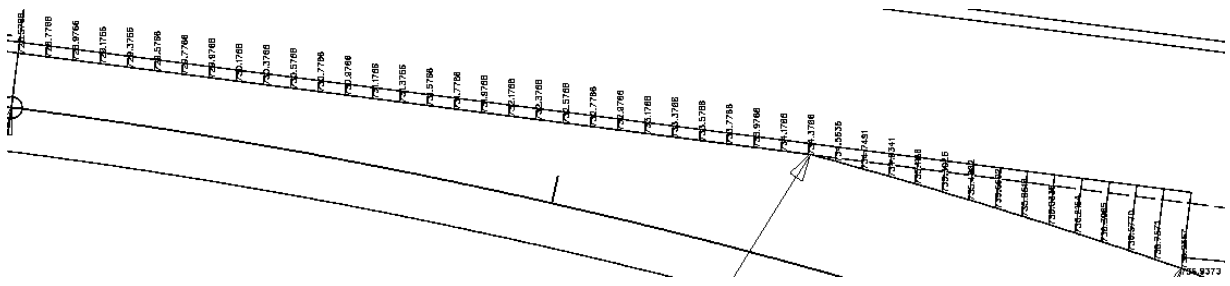
Set up the dialog as shown to the left. This tool will project elevations from the edge of the shape selected onto the next element chosen. This extrapolation can be **Non Transitional** or **Transitional**, which is chosen at the top of the dialog. The next part of the dialog is used to set the slope and direction of the extrapolation, which can be **Radial To Baseline** (used for the shape), **Radial From Element** (which is the current element), or **Radial To Element** to be chosen next.

Since the next element chosen will be the line representing the change in cross slope, the slope to the next element is the same slope as the mainline shape. In this example the mainline shape is non transitional with a cross slope of –2%, which is the value to be used. If the shape were in superelevation transition, the Transitional Extrapolation option would be used with from slope equaling the cross slope of the shape and the start of the ramp transition area and the to slope set to the cross slope of the shape at the other end of the ramp transition or the end of the shape, which ever comes first.

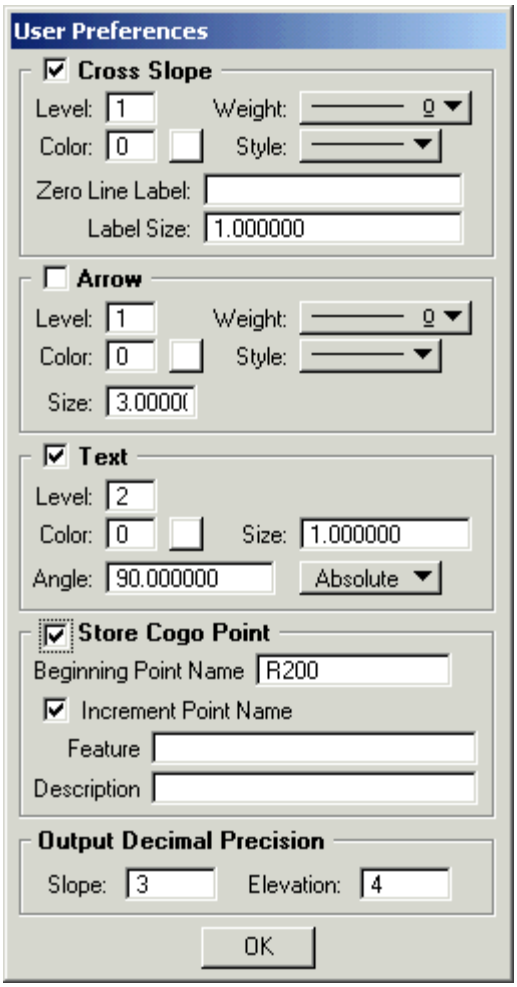


For the class example, plot the elevation along the next element chosen. To do this, go to **User > Preferences** in the Shape Profiler and **toggle on the Text option** as shown to the left. Click **OK** at the bottom of User Preferences to accept the change.

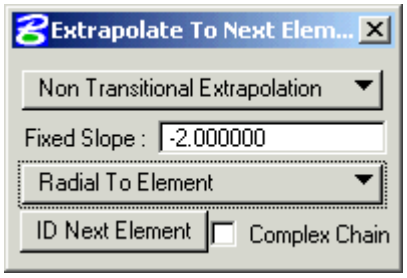
In the Extrapolate to Next Element dialog, click on the ID Next Element button and select the complex element created in the previous step. You should get the following results:



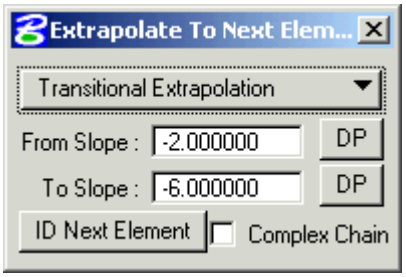
4. (Continued) The next projection is from the element just identified to the ramp chain. Since the elevations from the next projection will be used to create the profile for the first part of the ramp, preferences need to be changed. Also, it would nice to see the change in the cross slope at each point in the projection to verify that it is being done correctly. To change the preferences, go to **User > Preferences** in the Shape Profiler and **toggle on Cross Slope** and **Store Cogo Point**, as shown in the figure to the left. Click **OK**, to close the User Preferences dialog.



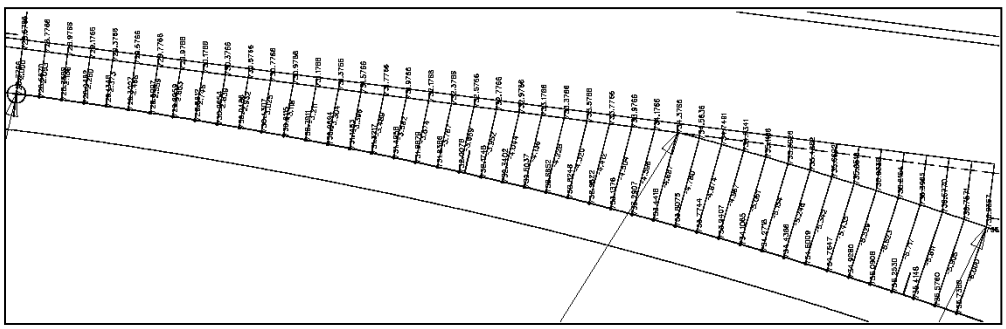
This extrapolation needs to be radial to the ramp chain since that is the direction of the cross slope for the ramp. To do this, switch the projection option to **Radial to Element** in the Extrapolate to Next Element dialog as shown below.



Because the ramp cross slope is in transition, change the first option to **Transitional Extrapolation**. This will change the dialog to the form shown in the next figure.



Set the **From Slope:** to **–2** and the **To Slope:** to **–6** as to the left. Click on the **From Slope: DP** and place a data point at the **start of the ramp**. Click on the **To Slope: DP** and place a data point at the **ramp nose**. The offset of these data points can be anywhere on or between the break line and the ramp chain. It is the station value that is used and not the offset.



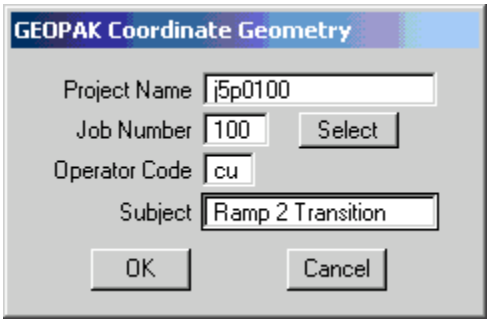
Click on the **ID Next Element** button and select the **ramp chain**. The results are shown in the figure to the left.

5. Close the Shape Profiler. If you look closely at the last projection line you will notice that is just short of the ramp nose. It was because of this that the Shape Analyst was used to project the Route 50 cross slope to the break line. Consequently, the elevation for the VPI for the ramp profile at the nose of the ramp needs to be calculated. It is the elevation at the nose end of the break line + the cross slope on the ramp at that point time the distance from the break line to the ramp. For this example the calculation is:

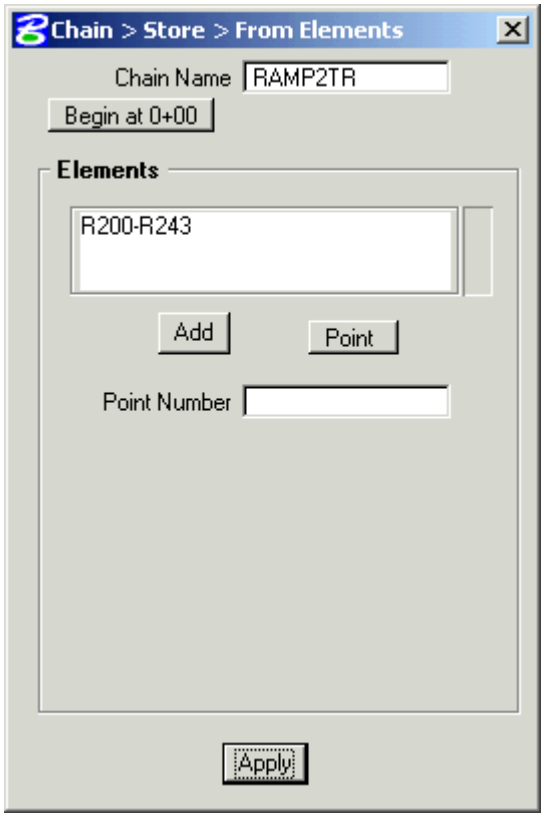
   VPI elevation = 736.9373 + (-6% * 20') = 736.9373 – 0.06 * 20
   736.9373 – 1.2 = **735.7373**

   This elevation will be used for the VPI at **Ramp 2 Station 2+12.438**.

6. **Open Coordinate Geometry** to look at the information for the points just created. Enter the session using the information shown in the dialog at the right.



   Open the COGO Navigator and look at the list of points. Scroll down until you get to Point R200. Click on **R200 to highlight that point**. Scroll down to the last point in the range. It should be point R243. **Hold down the shift key and click on the last point in the range to select all points in the range**. **Describe the points**. Notice that the points are about 5 feet apart and the stationing corresponds to that from the mainline. Before the points can be used to create a profile for the ramp, they need to be re-stationed to match the ramps stationing. To get an exact stationing, you would need to use the inverse along chain command to get the station values and then apply the corresponding station to each point one at a time. Because the points were spaced relatively close together, a short cut method can be used with virtually identical results. The short cut is to create a chain consisting of the range of points that begins at the appropriate station value. However, a slight inaccuracy is introduced because this chain goes from point to point, rather than along the curve of the ramp chain.



   Create chain RAMP2TR beginning at station 0+00 and consisting of the points R200-R243 as shown in the dialog to the left. Using the inverse command along the RAMP2 chain indicates that **point R243 is at Ramp 2 station 2+12.4187**. Describing the RAMP2TR chain indicates **that point R243 has been assigned the station value of 2+12.4185**. Thus will an inaccuracy is introduced, it is not significant.

7. The next step is to create the profile for Ramp 2. A key-in command needs to be used for this step. It has the following format: STORE PROFILE name pa-pi. Type in the following COGO command:

   S PRO RAMP2PR R200-R243

   Exit Coordinate Geometry.

8. Open the MicroStation file **t:\de-proj\cole\j5p0100\data\profile_J5P0100.dgn**.

   Copy the ramp2 working alignment to **RAMP2TR** and select that alignment. Enter the working alignment definition by clicking on the **Define** button.

   In the **Location section** under Profile View, set the following values:

   Horizontal Scale: **50**
   Vertical Scale: **10**
   Station Equation: **No Gaps**
   DP Station: **0+00**
   DP Elevation: **700**

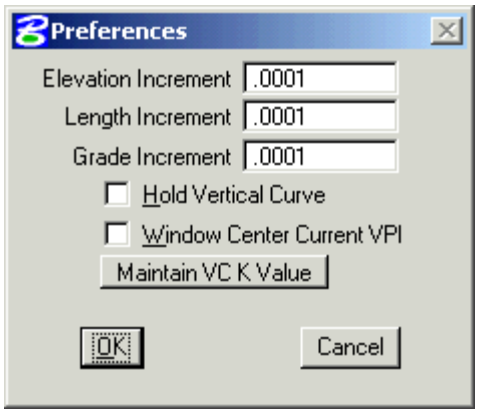
   Click on the **By DP** button and data point at in an open area in the drawing. Draw the profile cell at the DP by clicking on the **Draw Cell at X,Y** button.

   Close the working alignment definition box by clicking **OK**.

9. Open the **Vertical Alignment** generator using the profile cell plotted in the previous step.

   Select **File > Load** and load the profile **RAMP2PR**.

   Select **User > Preferences** and change the Elevation and Length Increment to 4 decimal places, as shown in the figure to the right.



   Go to last VPI and change following for VPI 44:

Station	Elevation
2+12.4370	**735.7373**

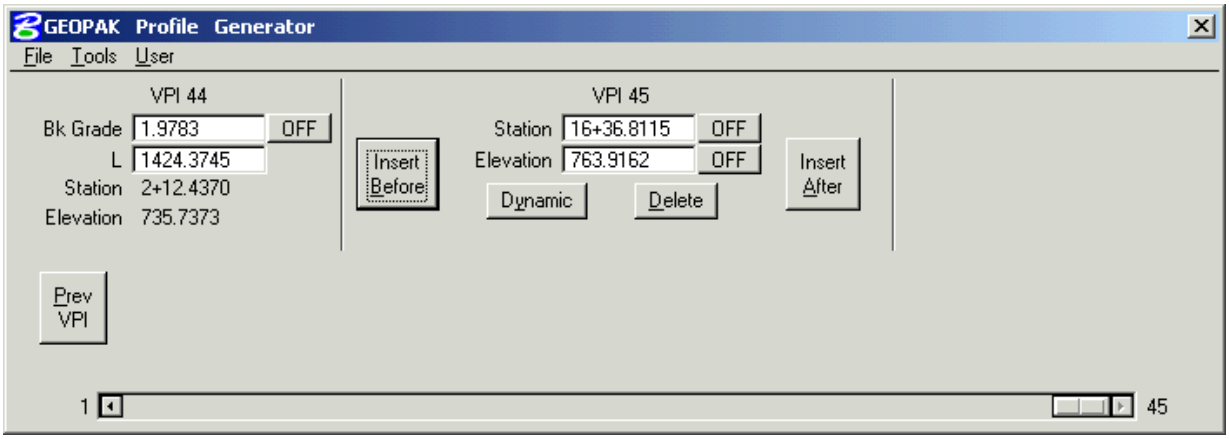
   This will move the VPI from R243 station and elevation to ramp nose. Note that the back grade is now 3.2096. Later a new VPI 45 will be inserted using a back rounded back grade of 3.2%.

   The profile needs to be extended for the rest of the ramp. This will be a two-part process. The first part will be to add a VPI based on the end of the ramp tying into the crossroad. After this, a new VPI will be inserted before the last VPI and it will be set using grade information.

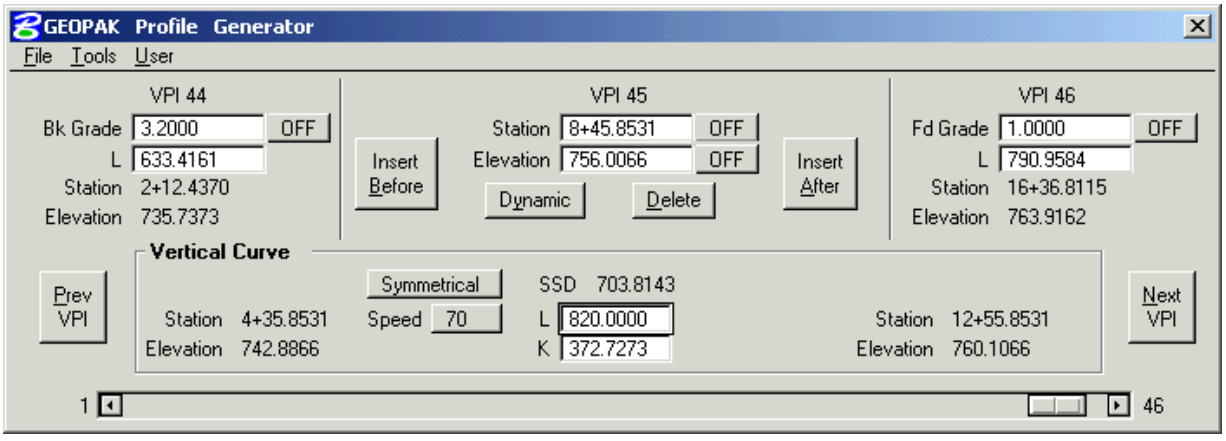
10. The last VPI for the ramp will be where the ramp chain crosses the crossroad gutter line. This point is offset 18.5' from the crossroad centerline. The elevation of the crossroad at this point and the corresponding ramp station has already been determined. Based on this, **insert a VPI at the end of the profile using the following VPI station and elevation**:

Station	**Elevation**
16+36.8115	**763.9162**

The dialog with this VPI is shown below. To enter the remaining VPI, press on the **Insert Before** button. This will insert a new VPI 45 with the VPI just stored moving to VPI 46.



At the new **VPI 45**, set the **Bk Grade to 3.2000** and hit the tab key. This will lock that value. Set the **Fd Grade to 1.000** and hit the tab key. This will lock that value and adjust the station and the elevation for the VPI, as shown in the following figure. Enter a **Vertical Curve** length of **820'**.



Save the profile as RAMP2PR and exit the vertical alignment generator.

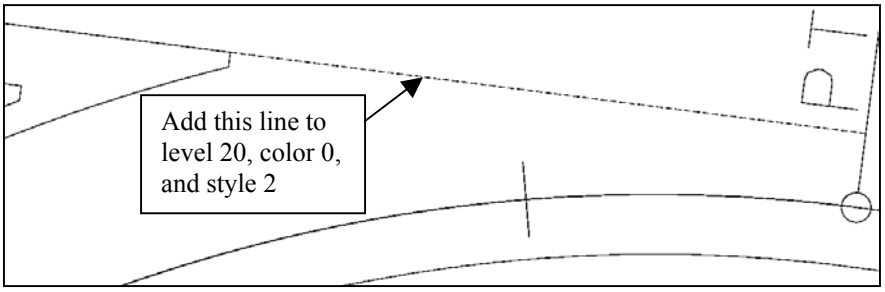
Update the working alignment definition by setting the **Proposed Profile to RAMP2PR**.

You may use D&C Manager to plot the profile **RAMP2PR**. **Save** the changes to the drawing.

11. Steps 1-10 have demonstrated a typical application of the procedure given at the beginning of this exercise. While this method will work for all cases, changes in the application of the procedure are needed for some situations. The rest of this exercise looks at two more cases to show most of the changes in application that will be encountered.

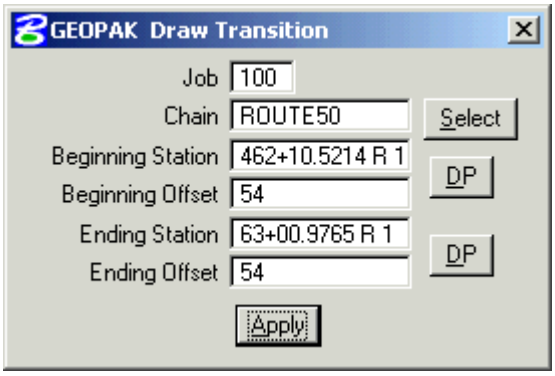
    Open the MicroStation file **t:\de-proj\cole\j5p0100\data\plan_50_J5P0100.dgn** and adjust the window area where Ramp 4 merges with the mainline. Ramp 4 is the loop on ramp for the eastbound lane.

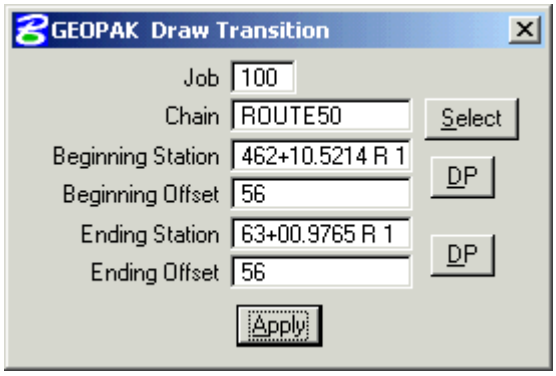
    Use **Draw Transition** to place a dashed pavement line offset 56' to the right of the ROUTE50 chain between the ramp nose and the end of the ramp to define the break in pavement cross slope between the mainline and the ramp. In this example a straight line without the curve is used to define the break in the slope. The result is shown to the left.



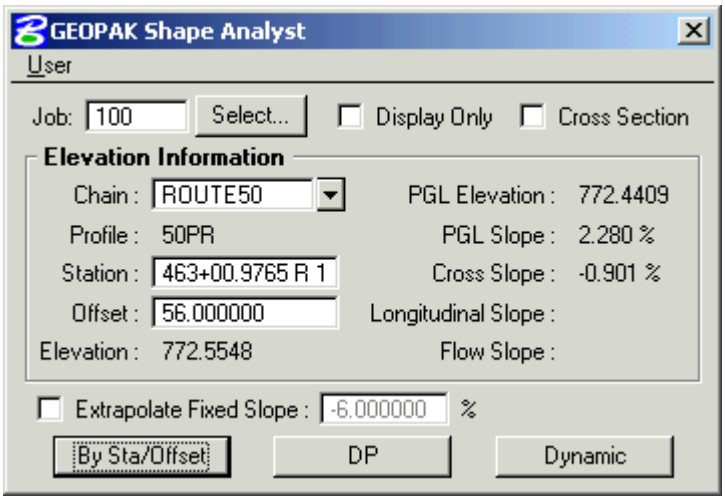
12. Open the MicroStation file **t:\de-proj\cole\j5p0100\data\ramps_shape.dgn** and adjust the window area to the beginning of Ramp 4.

    Notice that the stationing for the mainline runs is increasing from the ramp nose to the end of the ramp. Thus the extension of the line along the edge of the mainline shape next to the ramp is at the nose end for this situation. **Draw 2 lines on level 2 between ROUTE50 stations 462+10.5214 and 463+00.9765** (the station at the end of the ramp): **one** at an **offset of +54**' and **the other** at an **offset of +56'** from the chain as shown in the figures below. **Note**: Since the break line is made up of only one element, Step C from the Procedure given on page 2 of this exercise is not needed for this situation.





13. **Determine the cross slope on the ramp at each end of the transition**: Because of the tight radius of the ramp curve, the cross slope is the **8% maximum at the nose**. Since the mainline shape is in superelevation transition at the end of the ramp, use the Shape Analyst to determine the cross slope. You should get the results shown below indicating a cross slope of –0.901% for the mainline. Use a ramp cross slope of **+0.901% at its end point**.

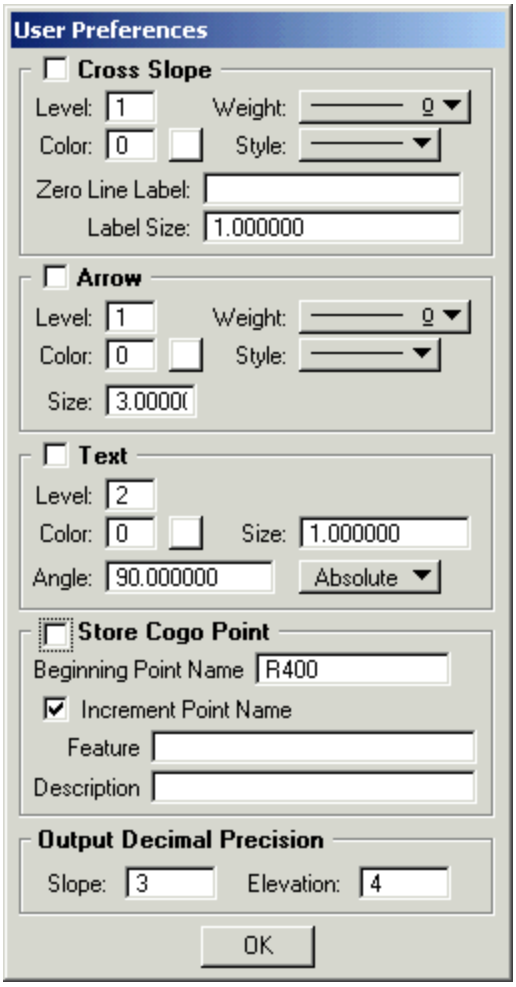


14. **Use the Shape Analyst to determine the elevation at the end of the break line as projected from the mainline shape**. Since the **By Sta/Offset** option for the Shape Analyst was used in the previous, the dialog show above gives the elevation as 772.5548. Thus, the elevation for the ramp profile VPI at the end of the ramp is:

    VPI elevation = 772.5548 + (-0.901% * 10') = 772.5548 – 0.009 * 10
    772.5548 – 0.0901 = **772.4647**.

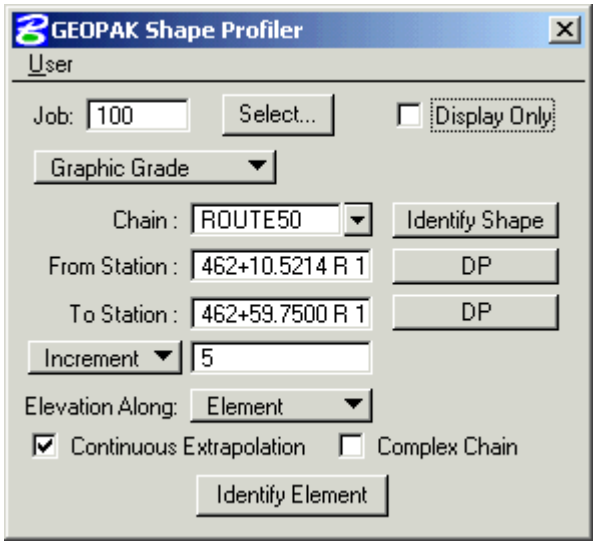
    This elevation will be used for the VPI at **the end of the Ramp 4 chain** for this situation.

15. **Use the Shape Profiler to store points along the ramp chain by projecting the cross slopes from the mainline**. After opening the dialog for this tool, go to **User > Preferences**



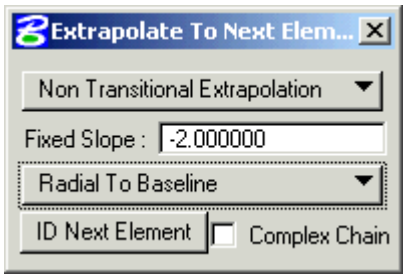
Turn **off** all of the options and set the **Beginning Point Name** to **R400**, as shown in the figure to the left. Select **OK** to close the User Preferences.

Click on the **Identify Shape** button and data point on the edge of the mainline shape **near the ramp nose**. Notice that the shape does not go all of the way to the end of the ramp. Press **DP** next to the From Station Field and snap and accept to the end of the break line near the end of the nose. Leave the To Station as the station for the end of the shape. You should get the station range shown in the following figure.



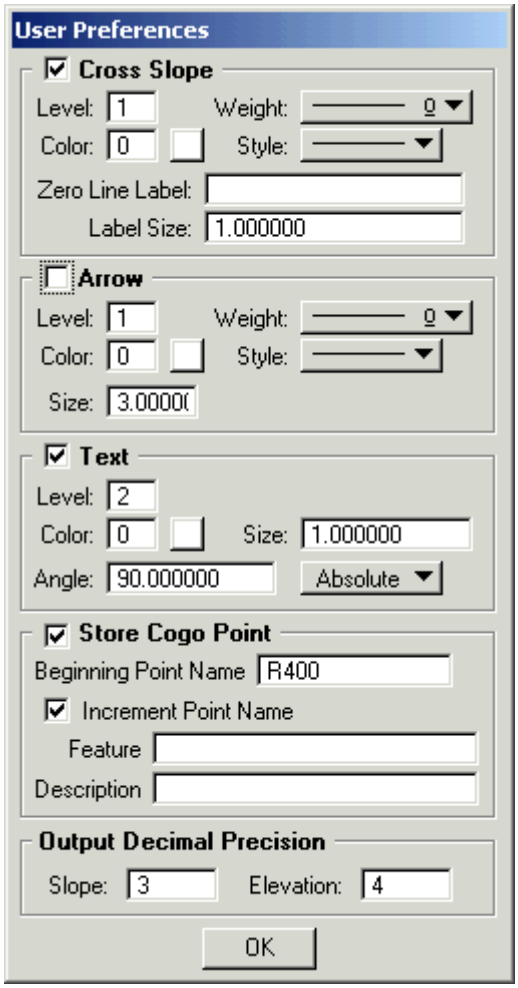
Leave the distance between points option to an **Increment** of **5**, **Elevation Along:** to **Element**, **Continuous Extrapolation toggled on** and **Complex Chain turned off**, as shown above. Go to **User > Preferences** and **turn on Text**.

Click on the **Identify Element** button and select line that runs along the edge of the Route 50 shape. This will bring up the following dialog:

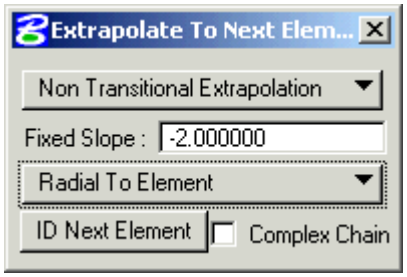


Set up the dialog as shown to the left. Since the next line is parallel to the main alignment baseline, any of the three options (Radial To Baseline, Radial From Element and Radial to Element) can be used since they will all produce the same result. Because the projection method does mater most of the time, select **Radial to Baseline**, click on **ID Next Element**, and **data point on the break line** defining the change in slope between the mainline and the ramp.

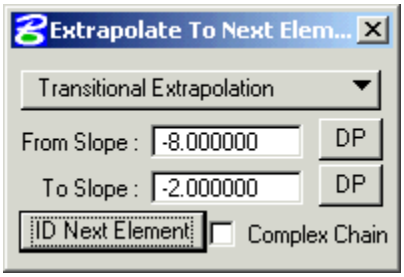
19. (Continued) The next projection is from the element just identified to the ramp chain. Since the elevations from the next projection will be used to create the profile for the first part of the ramp, preferences need to be changed. Also, it would nice to see the change in the cross slope at each point in the projection to verify that it is being done correctly. To change the preferences, go to **User > Preferences** in the Shape Profiler and **toggle on Cross Slope** and **Store Cogo Point**, as shown in the figure to the left. Click **OK**, to close the User Preferences dialog.



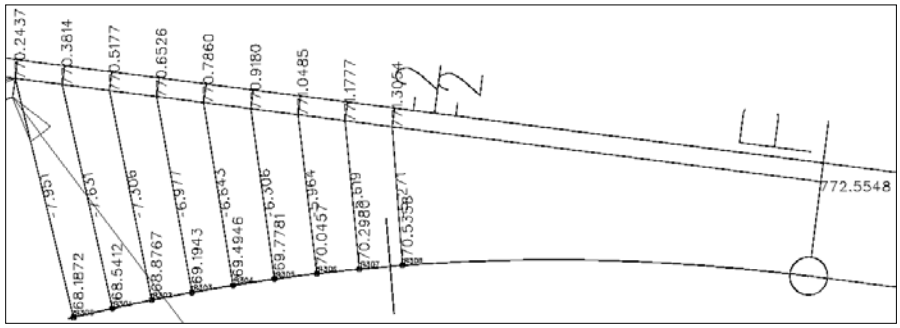
This extrapolation needs to be radial to the ramp chain since that is the direction of the cross slope for the ramp. To do this, switch the projection option to **Radial to Element** in the Extrapolate to Next Element dialog as shown below.



Because the ramp cross slope is in transition, change the first option to **Transitional Extrapolation**. This will change the dialog to the form shown in the next figure.

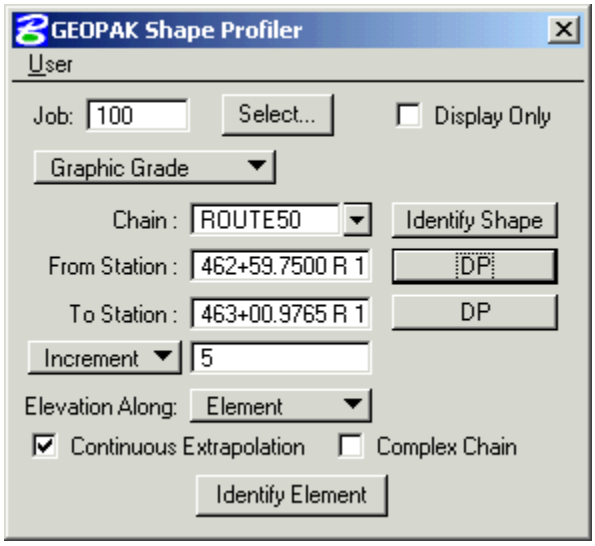


Set the **From Slope:** to **–8** and the **To Slope:** to **–2** as shown to the left. Click on the **From Slope: DP** and DP at the ramp side of the **ramp nose**, since the superelevation for the ramp is defined at that side of the nose. Click on the **To Slope: DP** and place a data point at the **end of the ramp** anywhere on or between the break line and the ramp chain. It is the station value that is used and not the offset.

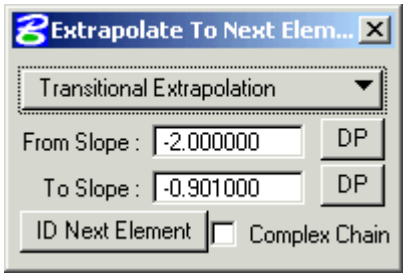


Click on the **ID Next Element** button and select the **ramp chain**. The results are shown in the figure to the left. Notice that only the first part of the ramp is done since that is limit of the shape.

16. Repeat the process for the rest of the ramp. To do this, **close Extrapolate to Next Element**. Turn off all of the Shape Profiler options by going to **User > Preferences** and **toggling off Cross Slope, Text, and Store Cogo Point**. Leave the Beginning Point Name alone to continue incrementing the point numbers.

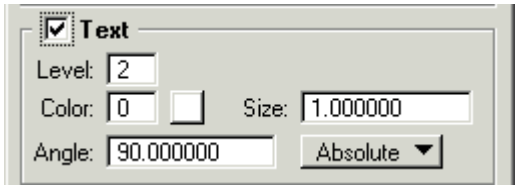


Click on **Identify Shape** and data point on the edge of the mainline shape **near the end of the ramp**. Leave the **From Station** as is. Press **DP** next to the To Station Field and set the station to the value at the end of the break line near the end of the ramp. You should get the station range shown in the figure to the right.



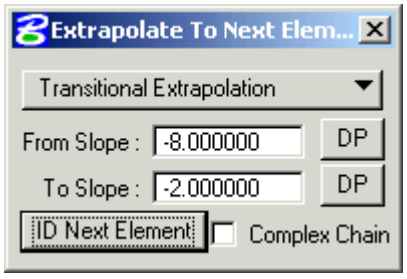
Click on the **Identify Element** button and select line that runs along the edge of the Route 50 shape. This will bring up the dialog to the left.

Set the dialog as shown and apply the From Slope to the beginning of the shape and the To Slope to the end of the ramp.



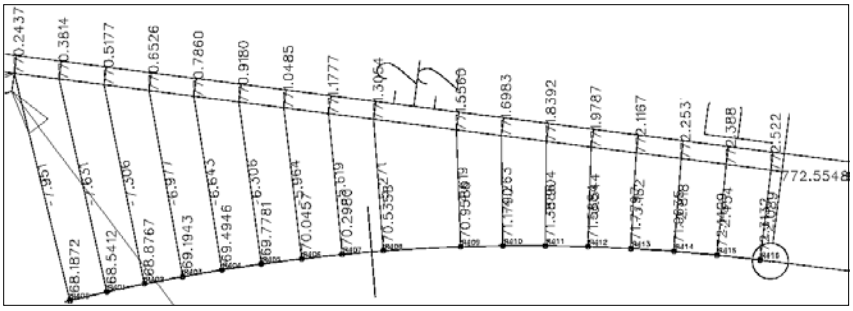
Go to **User > Preferences** and **toggle on Text**, as shown to the left. Select **OK** to save the changes.

Click the ID Next Element in the Extrapolate to Next Element dialog and ID the slope break line.



Return to **User > Preferences** and **toggle on Cross Slope and Store Cogo Point**. Select **OK** to save the changes.

Set the **From Slope:** to **–8** and the **To Slope:** to **–2** as shown to the left. Click on the **From Slope: DP** and data point on the ramp side of the **ramp nose**. Click on the **To Slope: DP** and place a data point at the **end of the ramp**.



Click on the **ID Next Element** button and select the **ramp chain**. The results are shown to the left. Notice that the second part of the ramp within the limits of this shape has been added.

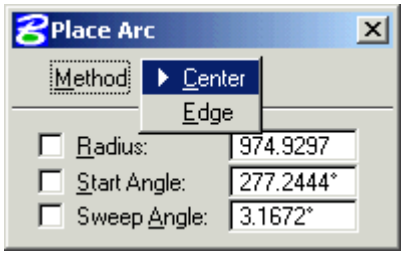
17. All that is needed to complete this case is to follow procedure steps G through J. Since this is a straightforward process, it is not repeated as part of this exercise.

18. One more case is considered. It is that provided by Ramp 3 for the project. In the current MicroStation file **t:\de-proj\cole\j5p0100\data\ramps_shape.dgn** window in on the Ramp 3 transition, which is the exit ramp for the west bound lane. This case is unique in that the stationing for the mainline and the ramp are running in opposite directions. This has two implications. The first is that plotted Ramp3 chain will not work as a projection line because it is orientated in the opposite direction from the mainline. Consequently, a MicroStation arc will need to be plotted in the file and orientated in the same direction as the mainline cure. The second implication is that an increasing point range will not work when creating the chain to re-station the COGO points. The order of the range must be reversed.

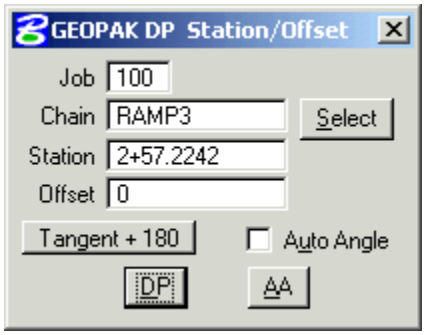
19. The location of the cross slope break line has already been added to the plan view drawing. Plot the needed lines in **ramps_shape.dgn**. Since the mainline stationing runs from left to right, the left end of the line along the mainline shape edge needs to start at a station value 5' feet before the nose in order to include the ramp nose in the shape profile projection. This is because the first included point is the increment value past the start of the line. The lines for the mainline will be added first.

    Use Draw Transition to place a line on level 2 at a constant offset of -54' from Route50 Station 476+84.0614 (476+89.0614-5) **to Station 479+55.2819**. **Draw a second line with a constant offset of -56' between Route50 Stations 477+73.4950 and 479+55.2819**.

    The lines for the ramp will need to be drawn using the **MicroStation Place Arc** tool and the **GEOPAK DP Station/Offset** tool. The arc with a Ramp 3 offset of 0' will be placed first.



Start the **Place Arc** tool with the **Method** set to **Center** as shown to the left. Set **DP Station/Offset** as shown to the right. Click on **DP** to start placing the arc. The next step is to locate the arc center.

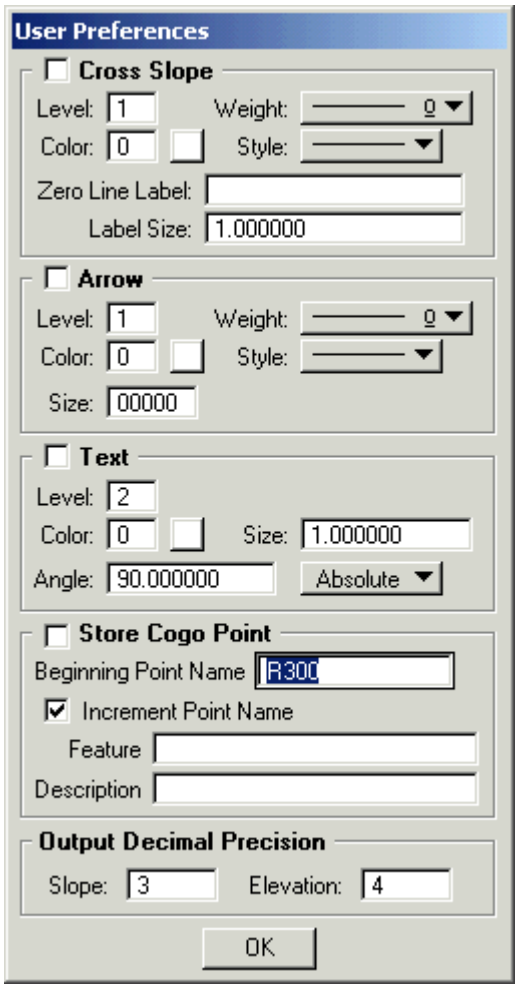


Use the **Center Snap** to locate the arc center at the center of curve RAMP3-1. Complete the placement of the arc by using either a key point snap to end the arch at the beginning of the ramp or DP Station/Offset to issue the ending data point at **RAMP3 Station 0+00** and an **offset of 0**.

Use the MicroStation **Move/Copy Parallel** tool to copy the arc just created 20' towards the mainline chain. Trim this arc so it ends at RAMP3 Station 1+75.4414 (ROUTE50 Station 477+73.4950) by any appropriate method.

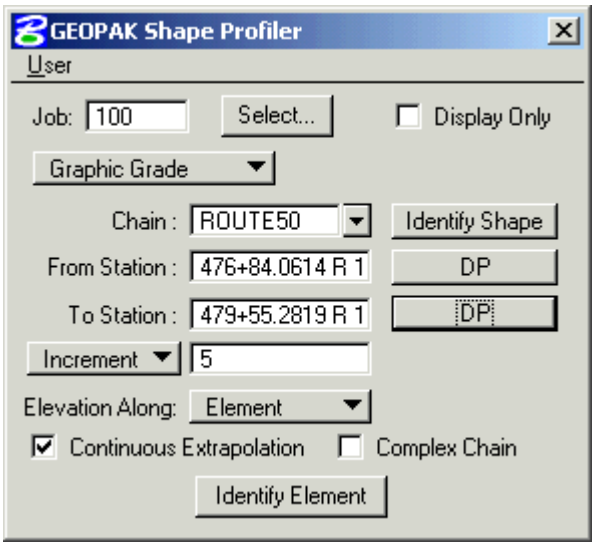
20. To make the next steps easier, **turn off the display for reference file plan_50_J5P0100.dgn**.

Use the MicroStation **Create Complex Chain** to join the two elements that define the change in cross slope between the mainline and the ramp.



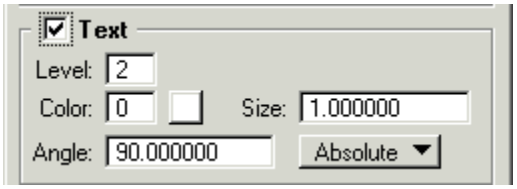
Start **Shape Profiler** and go to **User >Preferences**. Set the beginning point name to **R300** and turn off all of the display options as shown to the left. Click **OK** to accept the changes to the preferences.

In Shape Profiler, click on **Identify Shape** and select the mainline shape nearest to Ramp 3. Set the station range to those shown in the following dialog.



Click on **Identify Element** and select the line plotted along the edge of the shape.

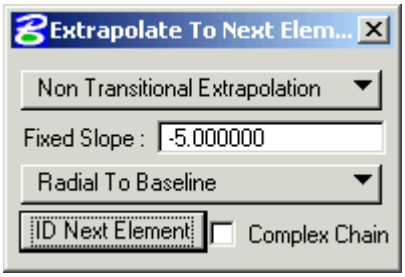
21. Return to **User > Preferences** and **turn on Text**, as shown to the right. Click **OK** to save the changes.



In the **Extrapolate to Next Element** dialog, set the following options:

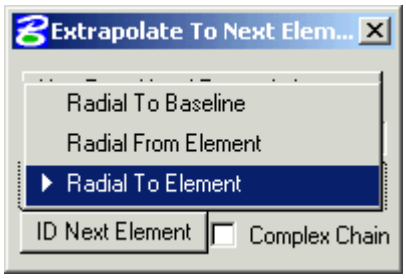
Non Transitional Extrapolation,
Fixed Slope of –5, and
Radial to Baseline as in the figure to the right.

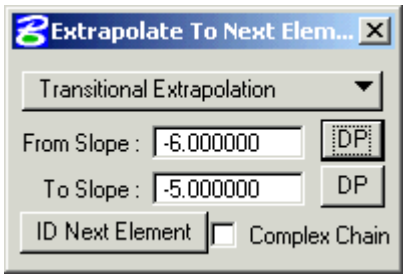
Click on **ID Next Element** and select the cross slope break line.



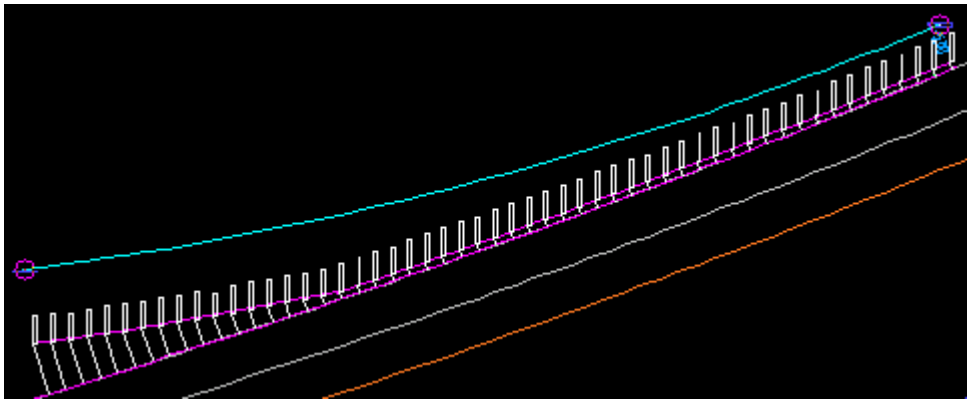
22. Under **User > Preferences**, **toggle on Cross Slope** and **Store Cogo Point**.

23. In the **Extrapolate to Next Element box**, change Radial to Baseline to **Radial to Element** as shown in the figure on the left below. Change Non Transition Extrapolation to **Transition Extrapolation** and set the following slopes: **From Slope: –6** & **To Slope: –5**, as shown below on the right.

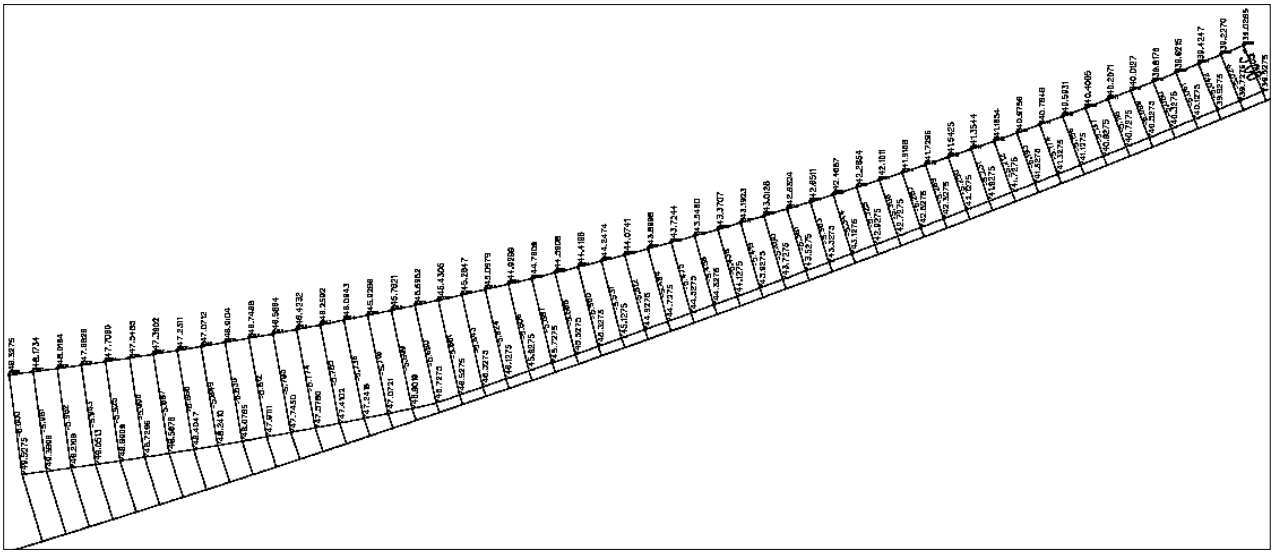




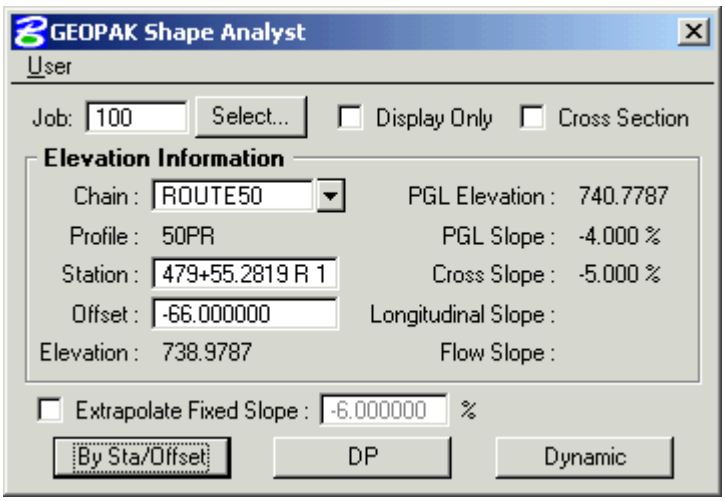
Set the **From Slope DP** at the left end of the projection to element and the **To Slope DP** at the right end of that line. The circles in the following figure indicate these points.



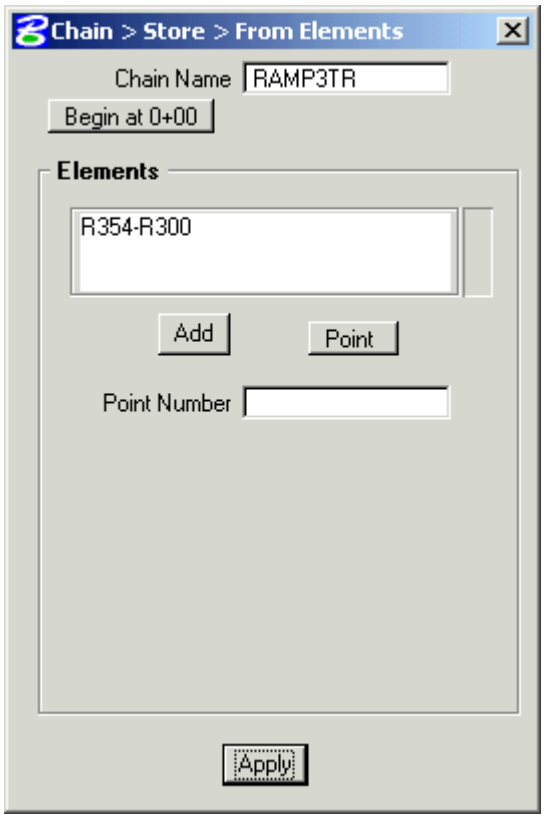
Click on **ID Next Element** and select the projection to line. The end results are shown below.



24. Use the Shape Analyst tool to store one more point. It is needed because a COGO point needs to be located here in order to re-station the points starting at 0+00. Enter the Station and Offset values shown below and identify the point by using the **By Sta/Offset** button. You should get the options shown.



25. In COGO, use **Element >Chain > Store > From Elements** to re-station the points by creating a chain using the **Begin at 0+00** option. Make sure the points are listed in reverse order (R354-R300) as shown below, where R354 is the point stored using the Shape Analyst tool at the beginning of the ramp and R300 is the first point stored using the Shape Profiler.



26. The COGO command to store the profile from these points needs to use the same reverse range option. The profile store command for the transition part of Ramp 3 is:

S PRO RAMP3PR R354-R300

Once this part of the profile is stored, the other VPI stations and elevation plus the vertical curves can be added to the profile using the Vertical Alignment Generator as was done for Ramp 2.